A Review of the Role and Impact of Export Processing Zones in World Trade : the Case of Mexico

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A Review of the Role and Impact of Export Processing Zones in World Trade: The Case of Mexico[1]

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Résumé

Tandis que le nombre de zones franches d'exportation (ZFE) a considérablement cru en 2000 pour atteindre environ le nombre de 850, leur succès sur l'emploi et le commerce est très mitigé. Le but de cet article est de faire un examen du rôle et de l'impact des ZFE dans le commerce mondial et plus particulièrement d'analyser son impact sur les économies des pays d'accueil. Nous nous intéresserons plus précisément aux indicateurs suivants : emploi, potentiel de revenus de devises étrangères, IDE et technologie. À cet effet nous regarderons le Mexique où les ZFE sont très développées. Le Mexique semble une étude de cas appropriée pour évaluer dans quelle mesure les prévisions de la théorie économique sont réalisées en raison de l'abondance et de la qualité des données disponibles et en raison de sa proximité vers les Etats-Unis. Nous analyserons comment les paramètres mentionnés ci-dessus ont évolué au cours des 10-15 dernières années. La source principale de données provient de la base INEGI (Instituto Nacional de Estadistica Geografica e Informatica) du gouvernement mexicain.

Mots-Clefs :Zone Franche d'Exportation, Mexique, transfert de technologie, IDE

Abstract

While the number of export processing zones has risen to about 850 in 2000, their success in expanding employment and trade is mixed. The aim of this paper is to make a review of the role and the impact of EPZ in world trade and its likely impact on host countries' economies, especially in terms of foreign exchange earnings potential, FDI, technology transfer, and employment effects on the local and national economies. To this end we will be looking at Mexico where export processing zones are very developed. Mexico seems an appropriate case study to assess to which extent the predictions of economic theory are realised both because of the abundance and quality of available data and because of its proximity to the US, which makes it a very good example of the international division of labour. We will analyse how the parameters mentioned above (employment, foreign exchange earnings potential, FDI and technology) have evolved over the last 10-15 years and how much of the change can be traced back to the maquila industry. The main source of data is INEGI, the Instituto Nacional de Estadistica Geografica e Informatica of the Mexican Government

JEL Classification: F13/F15/F21/F23

Keywords

Export Processing Zones, Mexico, technology spillovers, foreign exchange earnings potential

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1. Introduction and Definitions

Over the last 15 years, the outstanding high trade recorded by a selected number of developing countries can be partly attributed to the expansion of their "processing trade". Beside multilateral and regional trade liberalization, an increasing number of countries have modified their import regime by granting, under certain conditions, duty-free access to those imports which are bound for the processing and assembling of goods destined for exports.

While the number of export processing zones has risen to about 850, their success in expanding employment and trade is mixed. The object of this paper is to make a review of the role and the impact of EPZ in terms of foreign exchange earnings potential, FDI, technology transfer, and employment effects on the local and national economies, in world trade and its likely impact on host countries' economies, and specifically for Mexico 's economy.

1.1. What are EPZs?

Export Processing Zones (EPZs) are special industrial parks providing duty relief to export-oriented firms operating in the zones. They are enclaves within a country where foreign and domestic goods may enter duty free in order to be stored, distributed, combined with other foreign and/or domestic products, or used in manufacturing operations. EPZ have become rather popular trade policy instruments in the last three decades. An EPZ is a trade policy instrument used to promote non-traditional exports. When discussing EPZ, a variety of terminologies, such as industrial free zones, special economic zones and maquiladoras are used interchangeably through most of the literature. (see Table 1)

Table 1: *Terms synonymous with export processing zones (EPZ)*

TERMS	COUNTRIES
Maquiladoras/maquiladora (in-bond)enterprises	Costa Rica, El Salvador, Guatemala, Honduras, Mexico, Panama
Free zones	Costa Rica, Honduras, Ireland, Trinidad and Tobago, Turkey, United Arab Emirates, Uruguay, Venezuela
Special economic zones	China
Industrial free zones	Cameroon, Colombia, Ghana, Madagascar, Syrian Arab Republic and Jordan
Industrial free zones for Goods and services	Colombia
Free trade zones	Bulgaria, Chile
Export free zones	Jamaica
Free trade and industrial zones	Islamic Republic of Iran
Special export processing zones	Philippines
Export processing free zones	Togo
Tax free factories	Fiji
Bonded zone	Indonesia
Free zones and special Processing zones	Peru
Free economic zones	Russian Federation
Industrial estates	Thailand
"Points francs" (special industrial free zones)	Cameroon

Source: Legislation and publications of governments and EPZ authorities.

The diversity in name reflects the evolving nature and distinct purpose of each zone, and while the stated objective of the government is reflected in its terminology, the actual operation of the enclave can be quite different.

The general concept of all these terminologies is basically the same. But, according to some authors, Free Trade Zones (FTZ) include EPZ, but many export processing zones are not free trade zones. Rhee, 1990, defines FTZ as EPZ with free trade and other equal footing export policies, which include realistic exchange rate, inputs and capital goods at world prices, easy access to investment licensing and financing for the creation of export production capacities.

The ILO/UNCTC suggests the following definition: "… an EPZ could be defined as a clearly delineated industrial estate which constitutes a free trade enclave in the customs and trade regime of a country, and where foreign manufacturing firms producing mainly for export benefit from a certain number of fiscal and financial incentives."

For our paper, we assume, as the World Bank does[1], that "*an export processing zone is defined as a territorial or economic enclave in which goods may be imported, stored, repacked, manufactured, and reshipped with a reduction in duties and/or minimal intervention by customs officials*".

1.2. Why do countries use EPZ?

Usually, there is agreement about the objectives of an EPZ, but there is no general consensus about their definitive characteristics. None the less, there are a few common features to these zones. At first, they were conceived as fenced-in production areas. A long existing alternative is the export processing firm (EPF), which benefits from some of the EPZ incentives without being fenced in an identifiable area.

Box 1: Main benefits of EPZ

The Main benefits that host countries derive from EPZs

Traditionally, there are four main benefits in establishing EPZ.

- Provide foreign exchange earnings by promoting non-traditional exports

- Provide jobs to alleviate unemployment or under-employment problems in the host country.

- Attract foreign direct investment (FDI) to the host country

- Lead to technologic transfers, knowledge spillover and demonstration effects that could act as catalysts for domestic entrepreneurs to engage in production of non-traditional products.

EPZ can be differentiated by their ability to sell their output in the market of the host country. Those which are not permitted such a transaction fit the more traditional definition of EPZ. Some countries have adopted a more flexible stance with regards to such sales and allow some percent of the EPZ production to be sold on the domestic market after appropriate

[1] Madani, D., 1999, "A review of the Role and Impact of EPZ", World Bank.

import tariffs on the final goods are paid. It is, for instance, the case of Dominican Republic who allows up 20 percent of the EPZ products into its domestic market. A category of EPZ permits the free sale of its products on the domestic market. For instance, Manaus in Brazil is one such zone (Rodriguez 1996)[2].

Zones can also be divided into public and private zones. In the past 10 to 15 years, an increasing number of zones have been developed and are being managed by private entities.

Traditionally, EPZ have been associated with underdeveloped economies that desire to exploit some existing comparative advantage in order to improve their economic status. In some cases, EPZ were created as open market within an economy that is dominated by distortionary trade, macro and exchange rate regulation, and other regulatory governmental controls. (see Table 2)

Table 2 : The Potential Gains from EPZ

Increased foreign exchange earning
Increased Gross Export
Job Creation and Income Creation
Average wage in EPZ higher than average wage outside the zone
Good source of Labor training and learning by doing
Management and supervisory training
Catalyst effect
Provides efficient industrial structure in countries that may not possess one

Source: World Bank, Dorsati Madani, "A review of the Role and Impact of EPZ", 1999.

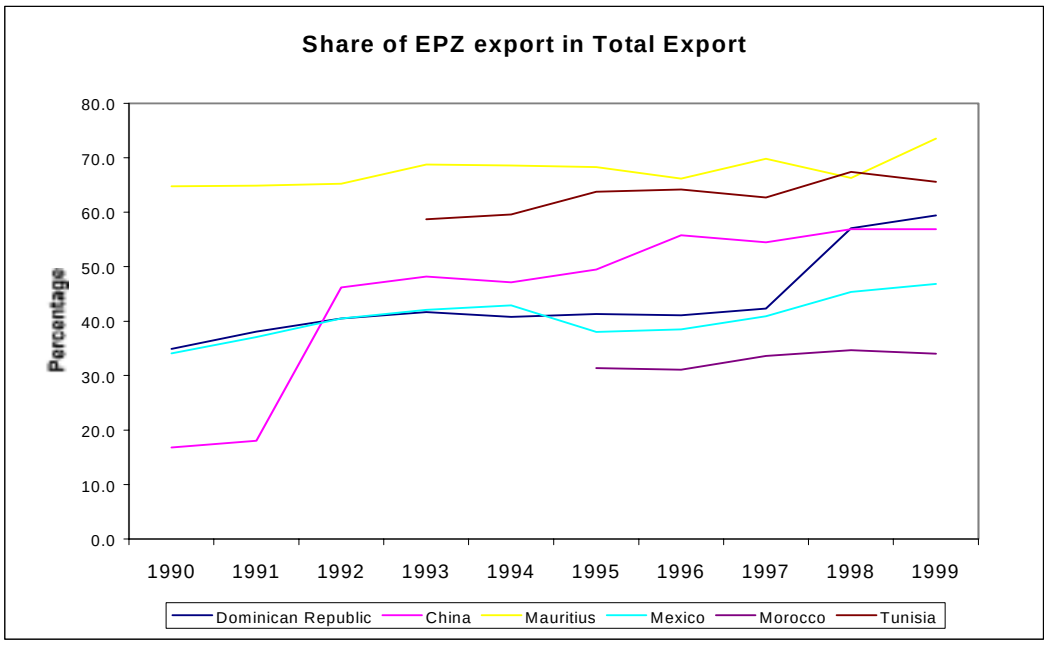
According to Madani (1999), there are four competing views on the role of EPZ in an economy. One considers it as an integral part to further economy wide reforms. EPZ are to have a specific life span, losing their significance as countries implement systemic trade, macroeconomic and exchange rate reforms. A second view sees EPZ in terms of a safety valve. They provide much-needed foreign currency to accommodate import needs for the host nation and create jobs to alleviate some of the national unemployment or under-employment. A third view is that EPZ can be used as laboratories to experiment with market economy, outward oriented policies. Finally, all these views still consider the EPZ as a source of technological transfers and human capital development. It is also interesting to note that in the past thirty years, EPZ have been implemented at two different development stages.

One set of countries (Mauritius, Dominican Republic, China) have reverted to them in the early stages of their industrial development, with the expectation that they provide the "engine of growth" to propel their economies into industrialization. They also sought production and export diversification. (see Graph 1).

[2] Rodriguez, Manuel, 1996, "The Manaus Free Zone of Brazil", in R.L. Bolin (ed), Impact of 57 New EPZ in Mercosur, The Flagstaff Institute.

[3] World Bank, Dorsati Madani, "A review of the Role and Impact of EPZ", 1999.

Graph 1: The Share of EPZ export in Total Export



Source: Authors' calculations

A second set of countries (Tunisia, Malaysia, Indonesia, Honduras) implemented EPZ when they already had a strong industrial production and export sectors.

2. The Economic Argument for EPZ

Here, we will elaborate on the main arguments for the establishment of an EPZ by using economic indicators. This exercise is necessarily a comparative one. The arguments that we will present are not ranked in order of importance because EPZ have been established with one or more of these goals in mind.

The success of an EPZ, *vis-à-vis* the host country, should be examined dynamically. That means that we should take into consideration the stage of development of the EPZ as well as the bargaining power between the host country and the MNE and also the contribution to the objectives aimed at when the zone concerned was set up. However, this analysis is beyond the scope of this paper and will not be pursued further at this stage.

2.1. Foreign Exchange Earnings potential

As stated in the previous section, there are static (increased capital and capital goods) and dynamic benefits (technology diffusion, export promotion) from FDI. Whilst the static benefits of FDI are not to be neglected, it is the dynamic benefits from FDI which are most important and has raised the interest of many developing countries on FDI. We should be therefore looking at the impact that FDI in the maquila sector has had on technology diffusion, which we will do in a later section.

Foreign exchange earnings are one of the main benefits expected from an EPZ. It is argued that EPZ provide foreign exchange earnings that allow low income economies to slacken the foreign exchange constrains regarding their import needs for the rest of the economy. In some countries, for instance in Mauritius, EPZ exports earnings grew from 3 percent of total export earnings in 1971 to 52.6 percent in 1986 and 68.7 percent in 1994[4].

However, this first goal of EPZ - generating foreign exchange for the countries in which they are active - has not been an across the board and unequivocal success. While some countries have achieved a high level of net exports such as South Korea, others have not been able to close the gap between gross and net exports such as for instance Jamaica.

2.2. Attract foreign direct investment

The major benefits that countries derive from FDI in EPZ's can best be viewed as of two types. The first are short-term benefits, such as employment, and foreign exchange earnings and exports, which are the most formal as well as easily quantifiable and therefore the most often studied. The second type is the long-run benefits from EPZ operations, which lead to various indirect and informal externalities primarily through the development of linkages with the domestic economy (e.g. technology transfers).

Profitable FDI in a zone represents a showcase for domestic firms and potential entrepreneurs to learn from and copy.

It is quite difficult to estimate the return of FDI in a given location but, we can say that externalities from foreign investment can be both positive and negative. For instance, MNE's activities induce employment but at the same time can increase pollution levels.

2.3. Technology Transfer and Education Benefits

According to Blomström and Kokko (1997), much of the international transfer of technologies is linked to FDI. However, because of its nature, it has been argued that EPZs investment does not bring the same technology content as traditional FDI. Some of the reasons outlined are a lack of forward and backward linkages with the local economy as well as the low skill assembly type production in EPZs that leaves little room for technology diffusion.

As McIntyre, Narula, Trevino (1996) proposed, this variable should be examined from two angles. The first one is tangible transfers, such as the transfer of capital equipment and spillovers such as the development of auxiliary and support industries. The second one is intangible transfers, such as the transfer of skills.

With regards to technological transfers and spillovers, EPZ are, for the most part, labour-intensive, low-tech assembly firms, with little access to advanced technologies.
There is little direct research conducted on technology spillovers from EPZ. Studies such as Globerman (1979) and Nadiri (1991) suggest that spillovers have had a positive effect on host

[4] World Bank, ibid

country productivity levels, other studies such as Cantwell (1989) and Haddad and Harrison (1991) suggest that spillovers either are not occurring or have not been beneficial to all industries. Kokko (1992) attempts to resolve this and finds that the extent of spillovers depends on the technology gap between local and foreign firms. According to Kokko, spillovers are most likely to occur where domestic firms have a level of technology similar to that of the MNE and where market conditions encourage competitions. He notes also that these conditions are often not met by many EPZ in developing countries.

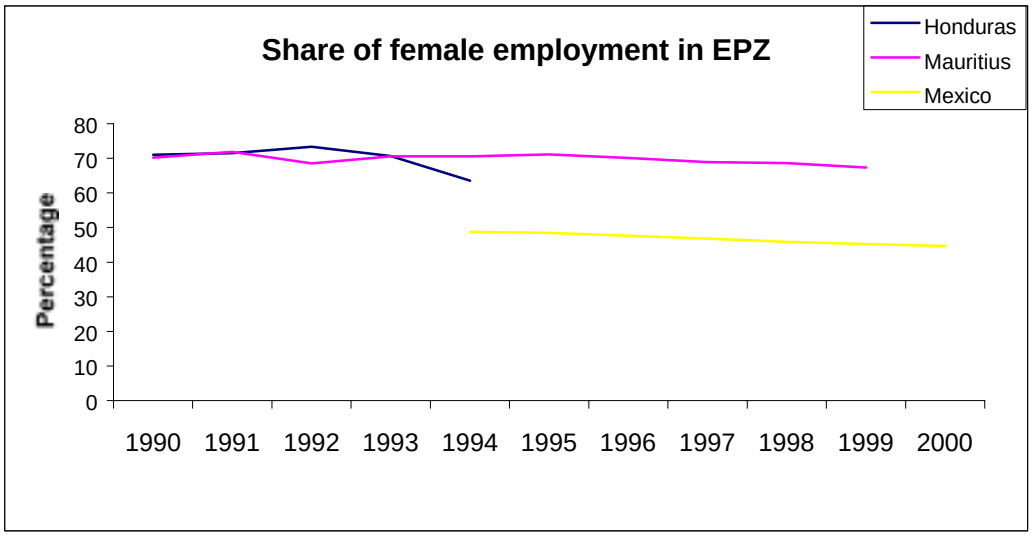
2.4. Employment Effect on Local and National Economy

Job creation is considered one of the primary goals and one of the most important contributions of any EPZ to the economy. The EPZ is often located in economically depressed areas.

According to the Organisation for Economic Co-operation and Development (Basile, 1984), most EPZs have a high rate of labour turnover (from 5 to 10% per month), primarily because of the important reserves of labour that include a very large proportion of female workers who retire young from the job market. Female workers are willing to accept lower wages than their male counterparts (usually 50% lower) and are more disciplined and often show more dexterity for assembly-type jobs. (Johansson Helena, Nilsson Lars,1997)

It should be noted, however that as the EPZ evolve towards more technologically advanced sectors the proportion of the female workers in the total labour force employed tends to decrease significantly (Madani,1999).

Graph 2: The Share of female employment in EPZ



Source: Authors' calculations.

Because of the low-skill assembly type activities undertaken in EPZ, employment in EPZ is usually concentrated in the lower end of the skill distribution of a country. This has several implications. On the one hand, it provides employment for those that usually face most difficulties in the labour markets. On the other hand, this low skill labour specialisation has implications for technology spillovers, wages and value added.

2.5. Conclusion

Developing countries need to be clear about the benefits they expect from EPZ. They should also consider the limited impact EPZ have often had with respect to employment, technology transfer, and foreign exchange earnings. Cost/benefit analyses must be dynamic, extending over the life of the EPZ, and should not be treated in isolation but rather as part of a complete government industrial policy (McIntyre, Narula, Trevino,1996)

3. The Impact of EPZ in Mexico' economy

3.1. Introduction

We now turn to analyse whether the expected benefits from EPZ have materialised in Mexico. To this end we will be looking at the performance of the four main indicators mentioned in the previous sections, employment, foreign exchange earnings potential, FDI and technology diffusion. As already stated, the EPZ industry in Mexico is especially suitable to analysis because of its proximity with the US, which makes it a very good example of the international division of labour, and because of its abundance and quality in data, provided by INEGI, the statistical office of the government of Mexico.

Before we analyse the different parameters it would be interesting to briefly introduce the development and current magnitude of the maquila industry in Mexico. Where does the word maquila come from? Maquila is a word of Arab origin and it means the portion of grain, flour or oil that the grinder charged the farmers for grinding its raw material. In its current usage it basically means a production process where the producer does not own part of the inputs, where production is undertaken for others.

By 1942 the US had an acute shortage of labour. To counter this the US and Mexican administration signed several treaties during the next 20 years, known as the "braceros" programs, where the US allowed for temporal immigration from Mexican workers to the US. These programs had a pull effect that caused an internal migration of workers to the north of the country, specifically to the border region. In 1964 the "braceros" program was terminated, the US did not renew its working permits for Mexican workers. The border region was plagued by high unemployment and the usual economic and social problems that high unemployment causes, with the aggravation that most of them had migrated and were uprooted from their natural surroundings. The Mexican administration developed then a program that aimed at attracting US investment to the Mexican side of the border to tackle the unemployment and lack of infrastructure problem. The maquila has developed much since, it can now be found all over the Mexican territory and its production is not anymore exclusively for export as it was until 1988.

However critical some authors may be of the maquila industry in Mexico, very few dispute its dynamism and its crucial role in dampening the economic adverse effects of the 94-95 crisis in Mexico (Capdevielle, 2001; Mattar and Hernandez, 2001).

Output in the maquila industry has been increasing steadily over the last decade. The following tables (tables 3 and 4) show the growth of the maquila sector for most of the nineties. It tripled in ten years. At the same time, manufacturing excluding maquila and total output were also increasing, but by far not at a similar pace. Maquila is only a small percentage in the productive structure of the Mexican economy, but its importance in manufacturing has been increasing steadily.

Table 3: Output in constant 1988 Mexican Pesos (billion)

	Maquila	Manufacturing Exc.-Maquila	Whole Economy
1988	22.4	240.0	683.7
1989	24.9	242.7	727.1
1990	25.3	244.2	763.4
1991	25.3	248.3	794.7
1992	26.6	244.8	818.0
1993	28.4	235.9	836.0
1994	34.5	245.4	892.9
1995	56.4	260.6	891.0
1996	60.6	276.1	905.3
1997	63.9	281.1	933.8
1998	74.7	289.5	982.4

Source: INEGI

Table 4: Output growth (of constant 1988 Mexican pesos)

	Maquila	Manuf. Non-Maquila	Whole Economy
1988	100.0	100.0	100.0
1989	110.9	101.1	106.3
1990	112.8	101.7	111.6
1991	112.9	103.5	116.2
1992	118.4	102.0	119.6
1993	126.8	98.3	122.3
1994	153.7	102.2	130.6
1995	251.5	108.6	130.3
1996	270.3	115.0	132.4
1997	285.0	117.1	136.6
1998	332.9	120.6	143.7

Source: INEGI

After acknowledging the impressive performance in terms of output growth, we now turn to consider what its impact has been on the economic parameters outlined in the previous sections.

3.2. Foreign Exchange Earnings Potential

Output or export performance of the maquila is not an indicator of the foreign exchange potential of the maquiladora industry. As several authors have argued (Vidal, 2000; CEPAL, 1998), the maquila industry has a very high import component, using minimal domestic inputs. This implies that as exports of the maquila grow, imports will also grow if some switching from imported to domestic inputs does not happen and the foreign exchange earnings potential of the maquila will not materialise. As Vidal argues, this switching is not happening and is unlikely to happen because the export capacity of Mexico in the sectors

where maquila is most successful is not endogenous, for exports to grow imports will also have to grow. The export performance of Mexico is highly dependent on the international division of production and therefore its growth is very likely to imply a growth in imported inputs also, so that the foreign exchange earnings potential of this type of industry is limited. To be able to assess the foreign exchange earnings of maquila we will have to look at net exports rather than exports. The following table gives us an idea of how much foreign exchange has been earned by the maquila industry.

Table 5: Net exports of the maquila industry **(billion US$)**

	Net Exports	Exports	Index NE	Index Exports
1991	4.1	15.8	100.0	100.0
1992	4.7	18.7	117.1	118.0
1993	5.4	21.9	133.6	138.0
1994	5.8	26.3	143.3	165.9
1995	4.9	31.1	121.6	196.4
1996	6.4	36.9	158.4	233.2
1997	8.8	45.2	218.1	285.3
1998	10.5	53.1	259.9	335.3
1999	13.4	63.9	331.9	403.3
2000	17.8	79.5	438.4	501.9

Source: INEGI

Net exports have been increasing at a similar pace than exports, the growth of exports has been accompanied by a correspondent increase in imports, so that although the absolute value of foreign exchange earnings has increased, its share as a % of maquila exports has not changed much. In the next table (table 6) we have estimated the share of imports in total maquila production.

Table 6: Imports in maquila in current Mexican pesos (million)

	Imports	Production	% Imports in Production
1990	29.0	39.0	74.4%
1991	35.6	47.8	74.4%
1992	43.2	57.9	74.6%
1993	51.4	68.2	75.4%
1994	68.7	88.2	77.9%
1995	163.5	194.1	84.2%
1996	231.5	280.8	82.4%
1997	287.6	357.7	80.4%
1998	390.9	487.7	80.2%
1999	481.1	609.6	78.9%

Source: INEGI

Imports have oscillated between 75 and 85% of total production for the last decade. The rise in imports in production in 1994/1995 could be more the consequence of exchange rate movements than actual changes in volumes (table 7). The sharp increase in the value of imports of 1995 could highlight the devaluation of the peso in 1994 and the afterwards slow recovery.

Table 7: Exchange Rates Mexican Pesos - US$

Year	*Exchange Rate Mex. Pesos per US$*
1990	2,840.91
1991	3,020.52
1992	3,095.00
1993	3.12
1994	3.38
1995	6.28
1996	7.60
1997	7.93
1998	9.15
1999	9.56
2000	9.47

Source: www.oanda.com

Capdevielle (2001) argues that most of the value added in the maquila industry is the wage bill. He calculates that only 3% of inputs in maquila are domestic inputs, showing how little links there are between the maquila and the rest of the economy.

The input composition of production is not only important because of its foreign exchange earnings potential, but it is also an indicator for the capacity of the maquila industry to generate technology spillovers and links with the local economy. The more foreign firms in the maquila industry rely on local content, the more exposed will be local firms to the modes of production and quality standards of foreign firms.

Although in absolute numbers net exports has been increasing over time, their share as a % of exports has remained very low. It would seem that the benefits of foreign exchange earnings of the maquila have been hampered by its extensive use of imported products.

3.3. Foreign Direct Investment

The available data on FDI in the maquila sector are very scarce. The share of FDI in maquila in total FDI has increased from 6% in 1994 to 23% in 2000. The increase of its share in total FDI is a product of both sluggish FDI inflows in the rest of the economy after the 1994/95 crisis (in table 8 we can appreciate a slump in FDI inflows to the rest of the economy in 1995) and impressive growth in maquila FDI.

Table 8: Annual FDI inflows (in current US$ million)

	Maquila	**Other Sectors**	**Total**	**Share of Maquila FDI in total FDI**
1994	895	14,060	14,954	6%
1995	1,366	8,157	9,523	14%
1996	1,417	8,485	9,902	14%
1997	1,680	12,161	13,841	12%
1998	2,111	9,506	11,616	18%
1999	2,778	9,137	11,915	23%
2000	2,983	10,179	13,162	23%

Source: Secretaria de Economia. Direccion General de Inversion Extranjera. Gobierno de Mexico.

FDI inflows have decreased between 1994 and 2000. However, as already stated above, this is the product of the 1994 crisis. If compared to 1995 instead of 1994, total FDI, both in the maquila and in other sectors, has grown. The dramatic fall in 1995 could be the result of both cheaper assets (due to a devaluating peso, see table 7) and decreasing FDI inflows due to investors' lack of confidence on the ability of the Mexican economy to recover quickly. As stated above, FDI has two components that make it interesting for developing countries. As a source of capital, although rather less so because there are other cheaper sources of capital, and technology.

The extent to which FDI in the maquila industry is able to narrow the technology gap between Mexico and the US depends amongst other things on the kind of production that is being pursued in the maquila industry. It is certain that the maquila industry was initially aimed at providing employment to Mexican workers that returned after the end of the "bracero" program and lived in the border region. However, many authors argue that it was hoped that with time the type of assembly being undertaken would develop and the technology component would rise, with the maquila industry taking a leading role in the modernisation process of the country.

In the next section we will be looking at the skill composition of the maquila industry and its evolution in the last decade, trying to elucidate whether there has been an upgrading of skills in the labour force or not.

Regarding the origin of FDI in the maquila sector, the next table (table 9) shows that maquila investment is strongly dominated by the US. One of the reasons is of course its proximity and increasing integration with the Mexican market. Another reason could be the foreign content regulation that rules the maquiladora regime that makes it less attractive for non-US firms to invest in the maquila sector. This could be reinforcing the dependence of the maquila industry on US demand, that may be a cause of concern when US demand for the services of the maquila decreases, as it is happening currently.

Table 9: Maquila FDI Origin 2001.

Country	Share
US	86.1%
Japan	4%
Switzerland	3.2%
Netherlands	1.3%
Singapore	1.2%
Spain	0.7%
Finland	0.6%
Others	3.0%

Source: Subsecretaria de Negociaciones Comerciales Internacionales

FDI inflows to the maquila sector have been increasing steadily for the period studied. The benefits derived from it are more evident when compared with the slump of FDI inflows to the rest of the economy in the aftermath of the 94/95 economic crisis. It remains to be seen whether FDI inflows benefits have been only in terms of capital or if it has also fostered technology diffusion.

3.4. Employment

Another of the benefits that EPZs usually bring (probably the most obvious one) is alleviation of unemployment in economically depressed areas. Because of its assembly type activity it primarily provides employment for those at the lower end of the income distribution, unskilled workers. As already mentioned the maquila industry was initially constrained to the border region with the US that suffered of high unemployment in the mid 60s. The primary aim of the Mexican Government at that time may have been to tackle the mounting unemployment problem. The maquila industry is increasingly settling down in other parts of the Mexican territory. The share of inland maquila employment in total maquila employment increased from 7% in 1988 to 18.9% in 1997 (CEPAL 1998). The expansion of the maquila to other regions probably reflects the fact that the Northern region in Mexico is nowadays by far not the poorest nor the region with the most pressing unemployment problem.

In order to be able to compare, before we analyse the evolution of employment in the maquila sector we should look at employment in general. In the following tables (tables 10 and 11 in the following page) we can see that from 1988 to 1998 employment grew by almost 7 million people. The largest increases were experienced in building activities, retail, restaurants and hotels and the social and personal services sector. A common characteristic of these three sectors is that they primarily signal employment in the non-tradable sectors. Manufacturing also experienced a sound increase of almost one million employees, and this could be capturing the shift in exports from agricultural and mineral to manufacturing products.

Table 10: Employment (in million)

	Total	**Agric.**	**Mineral**	**Manuf.**	**Building**	**Utilities**	**Trade**	**Transport**	**Finance**	**Social**
1988	24.1	6.3	0.2	3.0	1.9	0.1	3.9	1.3	0.5	6.8
1989	24.8	6.1	0.2	3.2	2.2	0.1	4.1	1.3	0.5	7.0
1990	26.0	6.2	0.2	3.3	2.5	0.1	4.5	1.4	0.5	7.1
1991	26.7	6.2	0.2	3.3	2.7	0.1	4.8	1.5	0.5	7.4
1992	27.2	6.2	0.1	3.4	2.7	0.1	5.0	1.5	0.5	7.6
1993	27.5	6.2	0.1	3.3	2.8	0.1	5.0	1.5	0.5	7.7
1994	28.2	6.3	0.1	3.2	3.1	0.1	5.2	1.6	0.6	8.0
1995	27.3	6.2	0.1	3.1	2.6	0.1	5.2	1.5	0.5	7.9
1996	28.3	6.3	0.1	3.3	3.0	0.2	5.2	1.6	0.6	8.0
1997	29.3	6.1	0.1	3.6	3.4	0.2	5.4	1.7	0.6	8.3
1998	30.6	6.3	0.1	3.8	3.7	0.2	5.6	1.8	0.6	8.5
1999	31.4	6.4	0.1	3.9	3.8	0.2	5.8	1.9	0.6	8.7

Source: INEGI

Table 11: Employment Index

	Total	Agric.	Mineral	Manuf.	Building	Utilities	Trade	Transport	Finance	Social
1988	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1989	102.9	97.9	94.2	104.4	112.3	102.5	105.8	105.5	101.7	102.2
1990	107.8	99.5	97.3	107.9	130.4	107.0	114.9	113.5	103.3	104.6
1991	111.0	99.3	95.9	109.0	137.5	109.5	121.7	117.2	107.0	108.7
1992	112.8	98.4	81.2	111.4	140.9	110.5	126.9	117.5	108.8	111.0
1993	114.1	99.7	71.5	109.1	146.3	111.3	128.1	118.2	110.5	113.0
1994	117.0	100.9	68.3	106.7	157.4	110.2	132.0	124.6	112.4	116.6
1995	113.6	98.9	67.5	101.1	136.4	112.4	132.2	120.0	110.9	115.8
1996	117.5	100.8	67.5	108.0	155.4	114.1	132.4	128.2	113.5	117.3
1997	121.9	97.7	69.0	117.5	177.7	116.9	137.3	134.1	119.2	120.9
1998	127.3	101.4	70.5	124.3	191.7	121.4	142.4	141.3	120.9	124.9
1999	130.5	102.7	70.5	128.9	197.3	130.5	147.1	146.5	122.2	127.4

Source: INEGI

However, if we divide manufacturing employment in maquila employment and manufacturing excluding maquila the picture that emerges is very different (table 12). Manufacturing excluding maquila has been almost stagnant between 1988 and 1998, whilst maquila employment has increased from around 300,000 workers in 1988 to almost a million in 1998. It seems that most of the manufacturing employment that has been created in Mexico in these years was in the export processing sector. This should not surprise us, if we bear in mind that the Mexican economy has undergone two major crisis in little more than 10 years, which obviously must have had an impact on domestic demand. Furthermore, at the same time the US (the main market of the maquila production) was probably experiencing the largest growth cycle in this century, with demand for maquila production increasing every year.

Table 12: Employment (in million)

	Total economy	Manufacturing excluding maquila	Maquila	Maquila as a % of manufacturing employment	Maquila as % of total employment
1988	24.1	2.7	0.35	11.5%	1.5%
1989	24.8	2.8	0.41	12.8%	1.6%
1990	26.0	2.8	0.43	13.1%	1.7%
1991	26.7	2.9	0.41	12.5%	1.5%
1992	27.2	2.9	0.48	14.3%	1.8%
1993	27.5	2.8	0.50	15.2%	1.8%
1994	28.2	2.7	0.54	16.7%	1.9%
1995	27.3	2.5	0.60	19.7%	2.2%
1996	28.3	2.6	0.73	22.2%	2.6%
1997	29.3	2.7	0.88	24.7%	3.0%
1998	30.6	2.8	0.98	26.0%	3.2%

Source: INEGI

Maquila as a % of manufacturing employment has increased from little above 10% in 1988 to over a forth by 1998. This is both the result of impressive employment growth in the maquila sector as well as stagnant employment in the manufacturing non-maquila sector. Whilst employment in the manufacturing non-maquila sector actually dropped during the 94 crisis, maquila employment kept rising during those years. It seems that in terms of employment the maquila sector has brought its promised benefits. However, its share in total employment, although rising, was as little as 3% by 1998.

One of the reasons for this unequal performance of the maquila and the rest of the manufacturing sector has been explained already, whilst maquila caters for the demand of the foreign sector, mainly the US market, the manufacturing sector excluding maquila also caters for the Mexican market. The unequal performance of the US economy, growing throughout most of the nineties, and the Mexican economy, affected by two significant crisis in the nineties, could well explain a large share of the different performance of the two sectors.

Another likely explanation is that we have Hecksher-Ohlin[5] type effects at work. In 1994 the NAFTA agreement between the US, Mexico and Canada entered into force. It is very likely that labour costs in Mexico are much lower than in the US or Canada, so that Mexico enjoys a comparative advantage in low-skill labour abundant activities. Why is the performance in the non-maquila manufacturing sector of the economy sluggish? As argued by Adrian Wood, 1997, it could well be that Latin American countries do not have a comparative advantage in low skill labour when compared to other countries (China, India and other Asian countries), so that part of the manufacturing industry is in retrenchment after the lowering of trade barriers.

It would be interesting to know what kind of employment is being created by the maquila industry. If we compare skill composition of labour in maquila (table 13) and manufacturing excluding maquila (table 14) it becomes evident that skill levels in the maquila workforce are much lower than in manufacturing excluding maquila.

Table 13: Share of skilled labour in total labour in maquila

	Total	Food	Textiles	Wood	Paper	Chemicals	Mineral no Metal	Basic Metal	Machinery	Others
1988	6.6%	8.9%	4.5%	6.8%	10.9%	7.1%	6.8%	9.9%	6.8%	7.7%
1989	6.8%	10.2%	5.1%	8.0%	13.6%	7.6%	6.5%	10.5%	6.7%	8.1%
1990	7.4%	10.1%	4.9%	8.0%	13.2%	7.2%	5.6%	9.5%	7.9%	7.3%
1991	7.8%	9.4%	4.8%	8.2%	10.4%	7.5%	5.7%	10.5%	8.7%	6.7%
1992	7.8%	9.7%	4.7%	7.9%	10.1%	7.4%	5.3%	9.2%	8.7%	6.3%
1993	7.5%	7.1%	4.5%	7.4%	8.8%	8.0%	5.3%	9.4%	8.6%	6.6%
1994	7.2%	9.4%	4.5%	7.0%	7.1%	7.9%	5.4%	7.0%	8.0%	6.9%
1995	7.1%	7.7%	4.3%	6.5%	5.3%	7.6%	5.7%	6.4%	8.1%	6.8%
1996	7.3%	6.2%	4.5%	6.5%	4.9%	7.8%	6.7%	7.9%	8.5%	6.8%
1997	7.2%	6.0%	4.5%	6.8%	3.9%	8.1%	6.7%	8.9%	8.4%	6.6%
1998	7.2%	7.2%	4.3%	6.3%	4.4%	8.8%	7.1%	10.0%	8.5%	7.0%

Source: INEGI

[5] Countries will tend to export goods whose production is intensive in factors with which they are well endowed.

Table 14: Share of skilled labour in total labour in manufacturing exc. maquila

	Total	Food	Textiles	Wood	Paper	Chemicals	Mineral no Metal	Basic Metal	Machinery	Others
1988	27.2%	29.2%	18.8%	15.8%	35.9%	34.8%	21.9%	28.8%	28.5%	32.4%
1989	27.2%	28.5%	19.1%	15.9%	36.7%	34.2%	22.0%	29.1%	28.5%	32.6%
1990	27.1%	28.6%	19.3%	15.7%	37.6%	33.4%	21.6%	29.5%	27.7%	32.6%
1991	27.3%	28.9%	20.0%	15.6%	39.0%	33.3%	21.7%	29.2%	27.1%	32.8%
1992	27.6%	29.4%	19.7%	16.4%	39.4%	33.5%	19.8%	30.0%	27.5%	34.5%
1993	27.6%	29.9%	19.8%	15.9%	40.2%	33.7%	21.6%	28.4%	26.7%	33.2%
1994	27.5%	29.8%	19.9%	15.9%	41.5%	33.6%	21.3%	28.8%	25.9%	31.8%
1995	28.0%	30.0%	20.0%	15.7%	42.4%	34.3%	22.1%	28.9%	26.4%	32.1%
1996	27.2%	30.1%	18.6%	14.9%	42.5%	33.7%	21.4%	28.9%	25.1%	30.8%
1997	26.7%	30.5%	18.0%	14.1%	42.0%	33.0%	20.7%	28.4%	24.4%	29.5%
1998	26.6%	30.9%	18.2%	13.8%	41.5%	33.3%	20.5%	28.4%	23.7%	30.2%

Source: INEGI

Skill composition in maquila has risen from 6.6% in 1988 to 7.2% in 1998. Most of this increase could be caused by the rise in skilled employment in machinery, by far the most important sector in the maquila industry. Within this group, office/telecom and automotive products make the bulk of maquila production, together over 60% of total output.

Skill composition of the non-maquila sector has gone down from 27.2% in 1988 to 26.6% in 1998. This could hint to a further development of the maquila and manufacturing sectors, that it is those sectors with the lowest skill composition (maquila, textiles, machinery) which seem to have grown most.

The skill composition of the maquila sector provides evidence of the kind of production being undertaken in maquila, and the speed at which production processes are being modernised. It does not seem that skill composition is being increased due to new technologies all that fast, if anything in machinery. This, coupled with the high import composition of inputs seems to indicate that the technology diffusion that many expected from the maquila sector is not taking place or only at a very slow pace.

Regarding the gender composition of labour, female labour in manufacturing has risen from 34.8% in 1991 to 37.5% in 2000 (table 15).

Table 15: Share of female labour in each sector

	Total	Agro	Mineral	Manuf	Building	Utilities	Trade	Transport	Finance	Services
1991	30.4%	12.3%	13.5%	34.8%	2.6%	14.3%	46.9%	8.8%	36.3%	44.9%
1993	30.7%	12.7%	3.5%	33.6%	3.4%	12.5%	47.1%	8.7%	39.2%	45.6%
1995	32.0%	14.4%	12.5%	29.9%	2.8%	15.3%	49.9%	8.6%	37.0%	45.4%
1996	32.5%	15.0%	7.1%	33.6%	2.6%	17.0%	46.5%	8.9%	33.7%	45.8%
1997	33.6%	17.5%	8.6%	35.9%	3.1%	14.0%	49.1%	7.7%	36.9%	44.9%
1998	33.5%	14.5%	7.8%	35.9%	3.1%	15.1%	48.3%	9.1%	36.0%	45.5%
1999	33.3%	14.6%	8.1%	36.3%	1.9%	12.7%	48.4%	10.9%	37.5%	45.3%
2000	34.1%	13.6%	11.6%	37.5%	2.6%	16.6%	48.6%	9.2%	37.4%	46.6%

Source: ENE (Encuesta Nacional de Empleo), Secretaria del Trabajo y Prevision Social

ENE also provides the composition of labour by gender and skill level in the maquila industry (table 16). ENE's figures somehow differ from INEGI's figures regarding skill composition, probably reflecting different definitions of skill level.

Table 16: Female labour in the maquila sector (in thousands)

	Total Labour	Female Unskilled	Male Unskilled	Skilled	Share Unskilled	Share Female Unskilled	Share Male Unskilled	Share Skilled
1994	583.0	284.0	193.0	106.0	81.8%	48.7%	33.1%	18.2%
1995	648.3	314.2	217.6	116.5	82.0%	48.5%	33.6%	18.0%
1996	753.7	359.0	257.6	137.1	81.8%	47.6%	34.2%	18.2%
1997	903.5	422.9	312.5	168.2	81.4%	46.8%	34.6%	18.6%
1998	1014.0	465.7	357.9	190.4	81.2%	45.9%	35.3%	18.8%
1999	1140.5	515.2	406.5	218.9	80.8%	45.2%	35.6%	19.2%
2000	1285.0	574.1	466.0	244.9	80.9%	44.7%	36.3%	19.1%
2001	1255.9	552.2	454.2	249.5	80.1%	44.0%	36.2%	19.9%

Source: ENE (Encuesta Nacional de Empleo), Secretaria del Trabajo y Prevision Social

As female labour and unskilled labour are usually in the lower end of the wage distribution, the gender and skill composition of the maquila sector could well explain the wage differential between the maquila and the non-maquila sector. Whilst this was 4 by 1998 in the maquila sector, it was only 2.8 in the manufacturing non-maquila sector (tables 17 and 18 below).

Table 17: Constant Wage Ratio Skilled/Unskilled in maquila

	Total	Food	Textiles	Wood	Paper	Chemicals	Mineral no Metal	Basic Metal	Machinery	Others
1988	3.2	2.9	3.3	2.6	3.5	2.7	2.5	2.7	3.3	2.6
1989	3.9	2.8	3.5	3.1	2.8	2.8	2.7	3.4	4.3	2.6
1990	3.5	2.7	3.6	3.2	2.6	2.8	2.9	3.6	3.6	2.6
1991	3.3	3.3	3.8	2.9	2.9	3.1	2.9	3.2	3.3	2.9
1992	3.4	3.1	3.9	3.0	2.2	2.9	2.9	3.0	3.4	3.2
1993	3.6	4.1	4.0	2.9	2.4	3.2	2.8	2.5	3.5	3.4
1994	3.5	3.5	3.8	2.8	2.6	3.4	2.9	3.4	3.4	3.4
1995	3.9	4.2	4.0	3.1	3.2	3.9	3.2	4.0	3.8	4.0
1996	3.9	4.5	3.7	3.2	3.3	3.9	2.9	3.8	3.7	4.4
1997	3.8	4.2	3.4	3.1	3.9	3.9	3.0	3.5	3.6	4.0
1998	4.0	3.8	3.5	3.1	4.1	4.0	3.2	2.7	4.0	4.0

Source: INEGI

Table 18: Constant Wage Ratio Skilled/Unskilled in manufacturing excluding maquila

	Total	Food	Textiles	Wood	Paper	Chemicals	Mineral no Metal	Basic Metal	Machinery	Others
1988	2.2	2.0	1.9	1.9	1.7	1.8	2.7	2.3	2.5	2.9
1989	2.4	2.1	1.9	2.2	1.7	2.0	2.9	2.4	2.7	3.1
1990	2.5	2.3	2.1	2.3	1.8	2.2	3.2	2.6	2.7	3.1
1991	2.5	2.2	2.1	2.2	1.8	2.2	3.3	2.8	2.8	3.1
1992	2.6	2.3	2.2	2.2	1.9	2.3	3.8	2.8	2.7	3.1
1993	2.6	2.4	2.3	2.3	1.9	2.4	3.3	2.8	2.9	3.2
1994	2.7	2.4	2.5	2.4	1.9	2.6	3.3	2.7	2.8	3.4
1995	2.8	2.4	2.4	2.3	1.9	2.6	3.6	2.9	3.0	3.5
1996	2.8	2.5	2.4	2.1	2.0	2.7	3.4	2.9	3.0	3.6
1997	2.8	2.5	2.3	2.1	1.9	2.7	3.3	2.7	3.0	4.0
1998	2.8	2.4	2.3	2.1	1.9	2.6	3.2	2.8	3.0	4.0

Source: INEGI

By looking at the input and labour composition in the maquila sector and comparing it to the rest of manufacturing it seems that the maquila sector has specialised in low skill labour intensive activities. Most inputs are imported, neither produced nor purchased locally, and labour is used mainly for assembly-type activities. Although the situation seems to be getting better progressively, it is far from clear that technology diffusion is taking place at all or only at an unsatisfactory pace. In order to be able to assess this better we will be looking at some case studies in the next section.

3.5. Technology Diffusion

As stated above, the benefits from investments in EPZs can be split into static and dynamic benefits. It is beyond the scope of this study to do an exhaustive study of the contribution of the maquila sector in Mexico on technology diffusion. However, reviewing the previous economic indicators and some studies that have been done on the subject we may be able to conclude something on technology diffusion.

First we could reconsider the economic indicators in the previous sections. We saw that imports in the maquila have been oscillating between 75 and 85% of production for most of the past decade. The value added in the maquila sector is mostly wages, with Capdevielle (2001) estimating that the local content in production is as little as 3%. This should give us an idea of the degree to which local industry is involved in the production process of the maquila sector.

Furthermore, as its name indicates, the Export Processing Zones are primarily export oriented. Although sales in the country are permitted by the Mexican legislation the literature reviewed agrees that the bulk of the maquila production is exported (CEPAL 1998). Since one of the main channels of technology spillovers from foreign investors are its backward and forward linkages and its impact on the market structure of the local industry we can infer that these channels of technology diffusion via FDI are being curtailed by the very nature of the maquila industry.

Another source of spillovers is through training and skill upgrading of labour in the foreign firms that then spread the knowledge in the local economy when taking employment with local firms. It is debatable to which extent the skill upgrading in the local economy is taking place.

We saw in the previous section that the skill composition of the maquila industry is much lower than in the rest of the economy due to its assembly type production. What is even more striking, is the fact that the skill composition of the labour force has hardly experienced any change, although it is true that whilst it has increased marginally the skill composition in the manufacturing sector excluding maquila has decreased marginally. There are no indicators of the mobility of labour from the maquila industry to the local economy.

It is difficult to say from this short analysis whether any spillovers from training of the local workforce are taking place, but we can say with a certain degree of assertiveness that the production being undertaken in the maquila sector has not changed much from 1988 to 1998 or at least it has not needed an upgrading in the skill composition of its labour force.

A CEPAL study in 1998 compares the technology composition of Mexico's exports with exports of other Latin American countries and finds that Mexico has increasingly made inroads in exports of higher technology goods, whilst Central America has specialised in basic manufactures (clothing). However, the papers argues that this does not mean that the technology sophistication of the production in the maquila sector in Mexico is rising, since much of the high technology exports may be just assembly-type productions of higher technology goods, without giving any indication of the sophistication of the production process in the maquila sector.

The study argues that the maquila industry in Mexico started with first generation industries: only assembly-type low skill labour intensive production, with very few linkages with the domestic economy. However, currently the most common type of industry in the maquila sector are the second generation industries, where new technologies are being introduced and where the stages of production being transferred to the maquila are increasing, although still showing very little integration with the domestic industry. The study also reports some cases of third generation maquila with skill intensive production, where R&D activities are being transferred from the headquarters. This type of industries still show little linkages with the local economy, although increasingly important intrafirm clusters. These three types of maquila are currently coexisting, but none of them seems to have many linkages with the local economy. Only through the gradual upgrading of skills and if these workers spread the knowledge to other firms will technology spread.

The study argues that the maquila sector in Mexico, as opposed to its counterpart in Central America and Dominican Republic, has achieved a higher degree of diversification and being involved in higher stages of the value added chain because of its maturity.

The study found evidence of increased productivity and efficiency in the maquila sector. They conclude that although there has been technological progress in the maquila, especially in organisation but also in human resources and technical processes, the bulk of the activities is still mainly of assembly type production. There is still primarily unskilled labour intensive production, therefore they conclude that maquila is not apt to induce modernisation of the whole economy. They argue that maquila will not be able to be the engine of sustained and equitable growth, but its contribution so far is positive.

Capdevielle (2001) estimates that only 3% of inputs are domestic. He argues that the level of integration between maquila and the Mexican economy is very low and decreasing. It is true that products being processed in maquila are increasingly complex, but the main activity is still assembly. He says that maquila has been beneficial for employment and foreign exchange earnings, but there has been very little technological upgrading. He implies that maquila has prevented manufacturing from declining even more, but it is not a sustainable source of growth and technological change for the future. A similar argument is advanced by Mattar amd Hernandez, 2001.

Mattar and Hernandez mention that maquila industry has been growing so fast (when the rest of the economy has suffered the 94-95 crisis and again in 97-98 a smaller crisis) because it has operated in an extremely flexible environment and because it is highly dependent on US demand. There is already some evidence of declining activity in the maquila industry of Mexico and Central America due to the current US economic downturn. They argue that the maquila was the only sector that was weakening the economic impact of the crisis during its

duration. They also mention that there are hardly any linkages nor technology spillovers from the maquila industry to the local economy, therefore they conclude that the growth of the maquila industry will not be sufficient for sustainable growth and technological spillovers.

Carrillo and Hualde (2000) compare the maquila industry in Mexico with the maquila in Central America and Dominican Republic and argue that the maquila in Mexico has undergone a modernisation procedure, its main industries being currently autoparts and electronics, whilst in Central America and the Dominican Republic the maquila is still highly concentrated in clothing. The authors introduce the case of Tijuana, where a cluster of second generation electronics firms has evolved, mainly from Asian origin. Production in these types of firms is more sophisticated, technologies being implemented are more advanced. There is some need for human capital upgrading and the firms in these types of industries have adopted some of the organisation and production processes from its Asian parent companies.

Nevertheless, the authors argue that there are still very few linkages with the domestic industry. They report that Japanese firms often develop whole manufacturing complexes, meaning they develop their own suppliers. At first these suppliers work exclusively with the Japanese firm but they increasingly serve new clients and develop new products.

They conclude that although there is evidence that production in the maquila in Mexico is being upgraded and more complex production processes are being undertaken, which require more modern technologies and the upgrading of skills of workers, there are still very few linkages with the domestic economy. It would thus seem that the modernisation of the economy and the technology spillovers that can arise will have to come from the upgrading of human capital that work in the maquila sector that afterwards goes back to work for the local economy.

From the lose analysis of the parameters in the previous sections and the literature reviewed it would seem that there is some evidence of technological upgrading of the production being undertaken in the maquila industry, away from clothing and into electronics and away from first generation to second generation industries. However, the maquila industry still shows very few linkages with the host economies, which could be hindering a faster path of technology upgrading and modernisation of the Mexican economy.

3.6. Conclusion

In this second part of the paper we intended to do a loose analysis of the main economic indicators that may be affected by EPZs as well as the impact of EPZs on the modernisation of the host countries taking Mexico as an example.

It seems that the maquila industry has been very successful in its aim of creating and alleviating unemployment. Another question which is beyond the scope of this paper is to assess the quality of this employment and the social conditions in which workers live and work. Much has been written about this issue, at this stage it is worth reminding us that maquila is creating employment for those at the end of the skill and income distribution in the Mexican society. It would be worth asking what would be an alternative scenario, meaning what would these workers be doing in the absence of the maquila industry?

It has been less successful in its role as a foreign exchange earnings source. Due to its high import composition, that does not seem to be changing much over time, the potential of the maquila industry in providing for much-needed foreign exchange is very limited. Some scholars (Dussell, 2000) even argue that due to its high import composition the export sector was responsible for the 94-95 crisis and it is likely to cause new disequilibria if it continues with its high import component.

Where the maquila industry has probably disappointed most is in its role as an engine for the modernisation and growth of the industrial sector in Mexico. Although there is evidence of some modernisation and upgrading of technologies in the maquila sector, it is not clear to what extent this is spreading to the rest of the economy. Due to its high import component and the low skill nature of its work force the activities of the maquila sector are unlikely to change the industrial infrastructure in Mexico.

In line with what other authors have argued, we can say that the maquila industry has been successful in its initial aim which was to alleviate unemployment and has been crucial in weakening the devastating impact of the economic crisis in 1994-95. However, if it is to serve as a source of modernisation and technology upgrading of the industrial structure of Mexico in the near future, it will have to change some of its features, like the skill composition of its labour force, given by its mainly assembly-type activities, and it will also have to create more backward (through increasing the production stages being undertaken in Mexico but also by increasingly relying in local suppliers) and forward linkages.

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